Citation:

Sawang, S. & Matthews, J. (2010). Positive relationships among collaboration for innovation, past innovation abandonment and future product introduction in manufacturing SMEs. *Interdisciplinary Journal of Contemporary Research In Business*, 2(6), p.106-117

Positive relationships among collaboration for innovation, past innovation abandonment and future product introduction in manufacturing SMEs

Sukanlaya Sawang

Judy Matthews

School of Management

Queensland university of Technology

Abstract

The importance of collaboration for firm level innovation has been well established but much of the research focuses on large firms, with little research on small and medium enterprises. This paper investigates the links between product innovation and external collaboration and between future product innovation and past abandonment in small and medium sized firms, analysing data from 449 manufacturing firms, collected through the Australian Business Longitudinal Database. Our findings indicate firms that sought ideas or solutions from external network such as suppliers, or business partners reported higher level of new product introduction than firms that did not have any external collaboration. Further, firms with past abandonment experiences reported higher levels of new product introduction than firms that did not have such experience. Additionally, the findings indicated that firms with external collaboration were more likely to introduce new products even if they had previously experienced abandonment of a product innovation than firms without external collaboration. Implications, limitations and future research are outlined.

Key words: innovation, collaboration, small firm, abandonment, manufacturing, survey

Positive relationships among collaboration for innovation, past innovation abandonment and future product introduction in manufacturing SMEs

1. Introduction

Innovation has been consistently identified as essential to firm's sustainable competitive advantage (Barney, 1991; Peteraf & Barney, 2003) and engaging in collaboration and cooperative activities has often provided opportunities to access complementary resources (Ahuja, 2000). Small and medium sized firms also engaged in linking and collaborative processes (Rothwell, 1991) sharing resources and sometimes co-production (Bönte & Keilbach, 2005). Some researchers argue that the boundaries of the firm are moving to increase corporate partnering, collaboration and an open innovation model (Chesbrough, 2003; Laursen & Salter, 2006). These more open relationships are also found with small and medium- sized firms (van de Vrande, de Jong, Vanhaverbecke & de Rochemont, 2009).

The importance of innovation for the Australian economy and the importance of collaboration as an enabler and enhancer of innovation has recently become a current focus of concern, with the recognition that the Australian innovation system consistently underperforms on most measures of collaboration and networking (Australian Innovation System Report, 2010). In 2007-08 the number of innovating firms increased to 39%, where manufacturing was one of the top three innovating sectors with 45.6% of those firms innovating, where 80% of innovation-active businesses had no collaborative arrangements in 2006-07 (Australian Innovation System Report, 2010).

An additional concern in innovation studies is innovation abandonment (Schillewaert, Ahearne, Frambach, & Moenaert, 2005). About 15% of all new product development is cancelled before completion and some companies have to face with devastating consequences (Iacovoc & Dexter, 2005). However, discarding innovation may not always be considered as a negative effect for the organization. This study thus investigates the past innovation abandonment influencing the future innovation adoption as well as a role of collaboration for innovation.

1.1 Innovation in Small and Medium Enterprises

SMEs are critical to almost every national and local economy. Not only do they directly provide a major component of manufactured output; they also are the essential seeds from which larger businesses grow (Duan & Kinman, 2000). In the Australian context, around 2 million small and medium enterprises employ 42% of population and contribute 16% of gross domestic product. According to the Australian Innovation System Report, in 2006 small sized firms represented 99.4% of all enterprises in Australia. In 2007-08, more than one third of Australian businesses reported implementing some form of innovation. The Australian government is concerned to encourage more effective dissemination of new technologies, processes and ideas to increase innovation across the economy, with a particular focus on small and medium-sized enterprises.

SMEs deal with unique size-related limitations (Woodcock, Mosey, & Wood, 2000). In particular SMEs which have limited resources are vulnerable in striving for innovation. SMEs can overcome the resources limitation through a collective innovation, i.e. a collaborative process that generates, develops, prioritizes, and engages in explorative or exploitative innovation (Benner & Tushman, 2002). Based on the problems faced by SMEs attempting to sustain or increase their market share, strategic planning related to innovation issues needs to be addressed.

The paper is structured as follows. First we briefly examine notions of innovation and its relationship to collaboration and frame some research hypotheses. Secondly we analyse data collected through a large government survey of small and medium enterprises. Finally we discuss implications of these findings and outline future research directions.

1.2 Collaboration for innovation

The terms of "collaborative arrangement," "cooperative arrangement," "strategic alliances," or coalitions" are used interchangeably (Forrest, 1990). Throughout this paper, we use the term "collaborative arrangement" or "collaboration" that focus on the product innovation. A number of studies indicated that collaboration is positively significantly related to level of product innovation among small to medium firms, but not to the larger firms (e.g. Hewitt-Dundas, 2006; Nieto & Santamaría, 2010). Small to medium firms often have to rely on the external resources or knowledge for product innovation. Small to medium firms employ collaboration as a mechanism to leverage market competitiveness and limitations for product innovation. As a result, we conclude that collaboration for product innovation may support small to medium firms' capability to innovate. Our first hypothesis is:

Hypothesis 1: Level of collaborative for product innovation will positively influence level of product innovation among small to medium firms.

1.3 Innovation abandonment

The development of new products and services is not a straightforward process. Firm's usually have some well defined processes for developing new products ranging from a stage-gate process with distinct decision making points (Cooper, Edgett, & Kleinschmidt, 2004) to design based processes with prototyping and testing of concepts and prototypes (Thomke, 1998; 2003) with combinations of existing products (Hargadon & Sutton, 1997) before the launch of new products or services.

Recent studies have found that product innovation projects consistently *fail* at alarmingly high rates (Belassi, Kondra, & Tukel, 2007). Past studies indicated that the innovation abandonment was an innovation failure within a firm. Perhaps, this conclusion was legitimate. However, if firms decide to terminate their product innovation due to cost-effectiveness purpose, the termination could do well than harm to the firms. Anecdotally, firms start their multiple product innovation projects simultaneously. Sometimes the market shifts dramatically, and firms decide to terminate a current project due to the environmental uncertainty. Then, firms can allocate their resources to a new project rather than risking further commitment to the current product innovation project and perhaps face the failure to launch the product successfully in the market. As a result, innovation abandonment could be caused by management failure, technology failure, learning from market testing or environment uncertainty.

Accordingly, innovation abandonment may not always be associated with firms' innovation performance. Using stage gate or design based development processes allows firms to develop, test and shape multiple possible products or services, potentially abandoning projects that are developed out of kilter with existing markets (Thomke, 1998). Firms that engage in product or service innovation usually engage in a number of processes to test out their ideas before settling on a small number of product or service offerings. Research on SMEs has shown that a lot of trial and error processes can be found as firms work with existing and new customers and stakeholders (Thomke, 1998). Contrary to previous beliefs, we argue that firms that experience past abandonment would be more likely to introduce an improved product innovation at a later time. Abandonment is a trial and error process as well as a learning process for firms, particularly SMEs. Therefore, we argue that past abandonment can possibly enhance the future of new product innovation.

Hypothesis 2: A level of past abandonment of product innovation will positively associate with future new product introduction among small to medium firms.

1.4 Collaboration can alleviate the effect between the past innovation abandonment and future innovation introduction

Firms also learn by interacting, with diverse stakeholders, through their consultation with suppliers, customers, consultants and through deep knowledge of products and markets (Jensen & Aanestad, 2007; Jensen, Johnson, Lorenz & Lundvall, 2007; Matthews & Becker, 2009). Their external collaboration provides a rich source of information about competitors as well as customers and shapes the potential for future projects and opportunities. Some research indicates that firms that benefit from external collaboration often have well functioning internal collaboration and integration of knowledge and information which processes the additional information to create value (Miles, Miles, & Snow, 2005).

A positive experience of product innovations will have knock-on effects to future innovations. Many innovation researchers (Damanpour, 1991a; Damanpour, 1991b; Frambach & Schillewaert, 2002;) have identified positive beliefs as a facilitator of repeat product innovation. As we argue previously, even though the innovation abandonment is often considered as a negative experience, this past experience can motivate SMEs to introduce a new product innovation in the future. Moreover, we propose that external collaboration would also enhance the relationship between past abandonment and future product innovation. Given that firms who collaborate with external partners (e.g. suppliers, business partner, and customers) would gain more knowledge and solution to the new product development. Sawang & Unsworth's (2010) study found that ideas for business solutions for SMEs came from customers and suppliers. Therefore, collaboration not only has a direct affect to innovation, but also can possibly moderate the past negative experience such as innovation abandonment and future innovation as well. Thus, the external collaboration would influence firms that demonstrate a high level of innovation abandonment introducing more product innovation projects than firms (with abandonment experience) without external collaboration.

Hypothesis 3: There will be a significant three way interaction among innovation abandonment, collaboration and level of introduce product innovation.

2. Method

2.1 Sampling

We analysed data from the most recent Business Longitudinal Survey (BLS) 2009 which was undertaken by the Australian Bureau of Statistics (ABS) during 2005-2007. Data were collected using self-administrated, structured questionnaires predominantly using closed questions. The sampling frame was all businesses on the business register employing less than 200 employees, excluding primary industries other than mining, government enterprises, utilities and public services. The BLS survey achieved a high response rate (>90%) which is much higher than in the academic research. The BLS data contains 2,732 small to medium sized enterprises (SMEs). This paper focuses on the manufacturing SMEs which represent 16.43% (449 firms) of all firms contained in the BLS data and we selected the questions which were related to innovation for our examination. The BLS included most of these additional innovation related questions for the first time in its survey in 2007, thus cross-sectional analysis is employed.

2.2 Measures

The measures used in this study are categorical data (i.e. yes/no) and they are distribution free and robust. Thus, we employed nonparametric statistical techniques to examine the hypotheses (Hair, Anderson, Tatham, & Black, 1998). Specifically we examined data from questions on new product introduction, innovation abandonment and external collaboration.

2.2.1 New product introduction. This question examines if firms introduce a new product or service in 2006-2007.

2.2.2 Innovation abandonment. This question investigates whether firms had abandoned the introduced new product/service in the 2005-2006.

2.2.3 External collaboration for innovation. This question is asked to determine the firms' collaborative activity in relation to innovation during 2006-2007. This question is an aggregated measure which includes multiple forms of collaboration with clients, customers, business partners and suppliers.

3. Results

A person chi-square test was conducted to assess whether firms' new product introduction was associated with the external collaboration (H1). The results of the test were significant, $\chi 2(1)=5.57$, $p<.05$. This seems to represent the fact that based on the odds ratio, firms with external collaboration were 3.1 times more likely to introduce a new product than firms that did not have an external collaboration.

Further, the person chi-square test was employed to assess a level of past abandonment of product innovation and the future new product introduction (H2). The results of the test were significant, $\chi 2(1)=5.07$, $p<.05$. This seems to represent the fact that based on the odds ratio, firms with innovation abandonment experience were 2.44 times more likely to introduce new products than firms that did not have the abandonment experience.

The third analysis aimed to examine Hypotheses 3, the relationship among past innovation abandonment the new product introduction and the role of business collaboration. Loglinear analysis was employed to examine the three-way interaction due to the nature of categorical data (Field, 2006). The three-way loglinear analysis produced a final model that retained all effects. The likelihood ratio of this model was $\chi 2$ (0) = 0, ns. This indicated that the highest order interaction (abandonment x external collaboration for innovation x new product introduction) was significant, $\chi 2$ (1) = 3.93, $p<.05$. The odds ratio indicated that collaborative firms were 4.30 times more likely to introduce new products even if they had previously experienced abandonment of a product innovation. However, non collaborative firms were only 0.58 times more likely to introduce the new product/service when they experienced the abandonment.

4. Discussion and conclusion

This study examined the role of external collaborators and product innovation among manufacturing SMEs in Australia. Additionally, this study also looked at the relationship between past abandonment of innovation and future product innovation. Our findings confirmed the positive relationship between (a) external collaborators and product innovation and (b) past abandonment and product innovation. We found that firms that sought ideas or solutions from an external network such as suppliers, or business partners reported higher levels of new product introduction than firms that did not have any external collaboration. The importance of collaboration for depth and breadth of a firm's innovation confirms existing research regarding such benefits (van de Vrande et al., 2009).

Further, firms with past abandonment experiences reported higher levels of new product introduction than firms that did not have such experience. Additionally, the findings indicated that firms with external collaboration were more likely to introduce new products even if they had previously experienced abandonment of a product innovation, than firms without external collaboration. The importance of collaboration with the abandonment of new products recently introduced could be interpreted as a sign of the firm's ability to monitor the performance of new goods into the market and resist the undue escalation of unwarranted commitment that often follows bringing new products to the market. This abandonment may also indicate that such innovative firms may continually launch new products and services and abandoning products maybe a consequence of more recent variations or product improvements. Abandoning or "killing" existing products can be a sign of market knowledge and technological advancement and efficient and effective processes for new product and service development (Cooper et al. 2004) and experimentation (Thomke, 2003). Furthermore the ability of firms to benefit from both collaboration and the abandonment of some effective new product and service design and development and implementation processes shapes their capabilities for ongoing performance.

While this study presents substantial research about a large number of manufacturing SMEs, with good completion of surveys, there are some limitations of this study. With small numbers in each category of collaboration it was necessity to aggregate all forms of collaboration under one. To some extent this has limited the identification of particular forms of collaboration, but these initial findings of positive results for the effect of collaboration indicates that further more detailed surveys of firms can target forms of collaboration in more detail.

The availability of the panel study with categorical data may have shaped some of the research possibilities of relationships between variables and has provided good quality data from large number of firms across many industries and the potential for further research possibilities in future.

Nonetheless, the findings from this study are significant for three reasons. Theoretically it provides support for the notion that innovative firms manage their innovation through managing knowledge and information flows as sources of innovation and market knowledge, which together may be components of broader dynamic capabilities of the firms (Jensen et al., 2007).

The research is also important for practitioners. The findings suggest that outsiders can play a key role in influencing decisions about innovation projects and provide avenues for development. These collaborations may be closer to a more open approach to firm level innovation than was previously discussed.

Our results have implications for policy makers. The benefits of collaboration for firms in the value chain and with customers and distributers has been well established, and previously identified in research on large firms. Increases in the engagement of firms in more open models of innovation with collaboration with multiple partners provides rich sources of information and market access for small and medium as well as large enterprises.

Innovation in small and medium size manufacturing firms will continue to be an important area of research (Chiesa & Manzini, 1998). Further investigation is planned to examine potential relationships between innovative firms and export activity, and patterns of change over time. The rich sources of data collected by government agencies and the potential for comparative research can be developed for further cross-sectional and longitudinal studies of collaboration and innovation in manufacturing SMEs.

5. References

Ahuja, G., 2000. The duality of collaboration: inducements and opportunities in the formation of interfirm linkages. *Strategic Management Journal* 21 (3), 317–343.

Australian Innovation System Report (2010). Department of Innovation, Industry, Science and Research, Australian Government, Canberra.

Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99-120.

Belassi, W., Kondra, A., & Tukel, O. (2007). New Product Development Projects: The Effects of Organizational Culture. *Project Management Journal, 38*(4), 12. PAGE

Benner, M. J., & Tushman, M. (2002). Process management and technological innovation: A longitudinal study of the Photography and Paint industries. *Administrative Science Quarterly, 47*, 676-706.

Bönte, W., & Keilbach, M. (2005). Concubinage or marriage? Informal and formal cooperation for innovation. *International Journal of Industrial Organization, 23*(3-4), 279-302.

Chesbrough, H. W. (2003). *Open Innovation-The New Imperative for Creating and Profiting from Technology*. Cambridge, Mass: Harvard Business School Press.

Chiessa, V. & Manzini, R. 1998 Organising for technological collaborations: A managerial perspective, *R&D Management*, 28, 3, 199 – 212.

Cooper, R. G., Edgett, S. J., & Kleinschmidt, E. J. (2004). Benchmarking Best NPD Practices. *R&D Management, 47*(1), 31-43.

Damanpour, F. (1991a). Organizational innovation: A meta-analysis of effects of determinants and moderators. *Academy of mangement Journal, 34*(3), 555-590.

Damanpour, F. (1991b). Organizational innovation: A meta-analysis of effects of determinants and moderators. *Academy of management Journal, 34*(3), 555-590.

Duan, Y., & Kinman, R. (2000). Small manufacturing business: meeting decision support needs. *Journal of Small Business and Enterprise Development, 7*(3), 272-284.

Forrest, J. E. (1990). Strategic alliances and the small technology-based firm. *Journal of Small Business Management, 28*(3), 37-45.

Frambach, R. T., & Schillewaert, N. (2002). Organizational innovation adoption. A multi-level framework of determinants and opportunities for future research. *Journal of Business Research, 55*, 163-176.

Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1998). *Multivariate data analysis with readings* (5 ed.). Englewood Cliffs, NJ: Prentice-Hall.

Hargadon, A., & Sutton, R. I. (1997). Technology brokering and innovation in a product development firm. *Administrative Science Quarterly, 42*(4), 716-749.

Hewitt-Dundas, N. (2006). Resources and Capability constraints to innovation in small and large plants. *Small Business Economics, 26*, 257-277.

Iacovoc, C. L., & Dexter, A. S. (2005). Surviving IT project cancellation. *Communications of the ACM, 48*(4), 83-86.

Jensen, M.B., Johnson, B., Lorenz, E. & Lundvall, B.A. (2007). Forms of knowledge and modes of innovation, *Research Policy,* 36, 680-693.

Jensen, T. B., & Aanestad, M. (2007). How Healthcare Professionals "Make Sense" of an Electronic Patient Record Adoption. *Information Systems Management, 24*(1), 29.

Laursen, K., & Salter, A. (2006). Open innovation: the role of openness in explaining innovation performance among U.K. manufacturing firms. *Strategic Management Journal, 27*(2), 131-150.

Lehman, W. E. K., Greener, J. M., & Simpson, D. D. (2002). Assessing organizational readiness for change. *Journal of Substance Abuse Treatment.*

Matthews, J. H., & Becker, K. (2009, December). *Innovation and Learning for Sustained Competitive Advantage: Preliminary findings.* Paper presented at the Australian and New Zealand Academy of Management (ANZAM) Conference, Melbourne.

Miles, R. E., Miles, G., & Snow, C. C. (2005). Collaborative Entrepreneurship: A Business model for Continuous Innovation. *Organizational Dynamics, 35*(1), 1-11.

Nieto, M. J., & Santamaría, L. (2010). Technological collaboration: Bridging the innovation gap between small and large firms *Journal of Small Business Management, 48*(1), 44-69.

Peteraf, M. A., & Barney, J. B. (2003). Unravelling the Resource-Based Tangle. *Managerial and Decision Economics, 24*, 309-323.

Rothwell, R. (1991). External networking and innovation in small and medium-sized manufacturing firms in Europe. *Technovation, 11*(2), 93-112.

Sawang, S., & Unsworth, K. (2010, 6-11 August). *Why Adopt Now? Multiple Case Studies & Survey Studies Comparing Small, Medium and Large Firms.* Paper presented at the Annual Meeting of the Academy of Management Conference Montreal, Canada.

Schillewaert, N., Ahearne, M., Frambach, R., & Moenaert, R. K. (2005). The adoption of information technology in the sales force. *Industrial Marketing Management, 34*(4), 323-336.

Thomke, S. H. (1998). Managing experimentation in the design of new products. *Management Science, 44* (6), 743-762.

Thomke, S.H. (2003) *Experimentation Matters: unlocking the potential of technologies for innovation*. Harvard Business School Press. Boston Mass. USA,

van de Vrande, V., de Jong, J. P. J., Vanhaverbecke, W., & de Rochemont, M. (2009). Open innovation in SMEs: Trends, Motives and Management Challenges. *Technovation, 29*, 423-447.

Woodcock, D. J., Mosey, S. P., & Wood, T. B. P. (2000). New product development in British SMEs . *European Journal of Innovation Management, 3*(4), 212-221.